In the Claims

1-20. Cancelled.

21. (New) A method of representing an MDS (multidimensional scaling) space as a hierarchical data structure, the MDS space defined by a set of points that correspond to a set of objects, wherein distances between pairs of points in the MDS space represent attribute proximities for the corresponding pairs of objects, the method comprising:

creating a root node comprising coordinates in the MDS space for a first subset of the set of points, the root node further comprising boundary information in the MDS space for local MDS spaces defined by further subsets of the set of points; and

creating a plurality of leaf nodes, each leaf node comprising coordinates in a local MDS space for the points in one of the further subsets.

22. (New) The method of claim 21 further comprising:

selecting the first subset of points based on the distances between pairs of points.

23. (New) The method of claim 22, wherein the largest distance between a pair of points is used as base criteria for selecting points for the first subset.

24. (New) The method of claim 21, wherein creating a root node comprises:

running MDS on the first subset of points to define the MDS space.

25. (New) The method of claim 21, wherein creating a plurality of leaf nodes comprises:

iteratively grouping the points remaining after selecting the first subset into the further subsets based on coordinates in the MDS space of the remaining points.

26. (New) The method of claim 25, wherein the points are grouped using a median cut algorithm.

27. (New) The method of claim 25, wherein the coordinates of the remaining points are calculated using a single node update process.

28. (New) The method of claim 25, wherein creating a plurality of leaf nodes further comprises:

running MDS on the further subsets of points to define the local MDS spaces.

29. (New) The method of claim 21, wherein each node further comprises a map relating distances between pairs of points in the associated MDS space with the attribute proximities between the corresponding objects.

30. (New) The method of claim 21, wherein the leaf nodes further comprise coordinates for any overlapping portions of the associated local MDS spaces.

31. (New) The method of claim 21 further comprising:

identifying a node for a new point corresponding to a new object based on attribute proximities between the new object and existing objects.

32. (New) The method of claim 31 further comprising:

adding the new point into the subset associated with the identified node; and

redefining the local MDS space for the identified node.

33. (New) The method of claim 32, wherein adding the new point comprises:

calculating coordinates of the new point using a single node update process.

34. (New) The method of claim 32, wherein redefining the local MDS space comprises:

running MDS on the subset associated with the identified node.

35. (New) The method of claim 32 further comprising:

recalculating the boundary information in the root node for the local MDS space for the identified node.

36. (New) The method of claim 32 further comprising:

redefining the local MDS space for a traversed node, the traversed node located between the root node and the identified node; and

recalculating the boundary information in the root node for the local MDS space for the traversed node.

37. (New) The method of claim 32 further comprising:

redefining the MDS space for the root node; and

recalculating the boundary information in the root node for the local MDS spaces.

38. (New) The method of claim 31 further comprising:

determining points in the subset associated with the identified node that are within a pre-determined distance of the new point.

39. (New) The method of claim 38 further comprising:

determining points in the subset associated with a traversed node that are within the pre-determined distance of the new point, the traversed node located between the root node and the identified node.

40. (New) A method of querying a hierarchical data structure of root and leaf nodes representing an MDS (multidimensional scaling) space defined by a set of points that correspond to a set of objects, wherein distances between pairs of points in the MDS space represent attribute proximities for the corresponding pairs of objects, the root node comprises coordinates in the MDS space for a first subset of the set of points and boundary information in the MDS space for local MDS spaces defined by further subsets

of the set of points, and each leaf node comprises coordinates in a local MDS space for the points in one of the further subsets, the method comprising:

identifying a node for a new point corresponding to a new object based on attribute proximities between the new object and existing objects.

41. (New) The method of claim 40 further comprising:

adding the new point into the subset associated with the identified node; and

redefining the local MDS space for the identified node.

42. (New) The method of claim 41, wherein adding the new point comprises:

calculating coordinates of the new point using a single node update process.

43. (New) The method of claim 41, wherein redefining the local MDS space comprises running MDS on the subset associated with the identified node.

44. (New) The method of claim 41 further comprising:

recalculating the boundary information in the root node for the local MDS space for the identified node.

45. (New)The method of claim 41 further comprising:

redefining the local MDS space for a traversed node, the traversed node located between the root node and the identified node; and

recalculating the boundary information in the root node for the local MDS space for the traversed node.

46. (New) The method of claim 41 further comprising:

redefining the MDS space for the root node; and

recalculating the boundary information in the root node for the local MDS spaces.

47. (New) The method of claim 40 further comprising:

determining points in the subset associated with the identified node that are within a pre-determined distance of the new point.

48. (New) The method of claim 47 further comprising:

determining points in the subset associated with a traversed node that are within the pre-determined distance of the new point, the traversed node located between the root node and the identified node.

49. (New) The machine-readable medium having executable instructions to cause a processor to perform a method of representing an MDS (multidimensional scaling) space as a hierarchical data structure, the MDS space defined by a set of points that correspond to a set of objects, wherein distances between pairs of points in the MDS space represent attribute proximities for the corresponding pairs of objects, the method comprising:

creating a root node comprising coordinates in the MDS space for a first subset of the set of points, the root node further comprising boundary information in the MDS space for local MDS spaces defined by further subsets of the set of points; and

creating a plurality of leaf nodes, each leaf node comprising coordinates in a local MDS space for the points in one of the further subsets.

50. (New) The machine-readable medium of claim 49, wherein the method further comprises:

selecting the first subset of points based on the distances between pairs of points.

51. (New) The machine-readable medium of claim 50, wherein the largest distance between a pair of points is used as base criteria for selecting points for the first subset.

52. (New) The machine-readable medium of claim 49, wherein creating a root node comprises:

running MDS on the first subset of points to define the MDS space.

53. (New) The machine-readable medium of claim 49, wherein creating a plurality of leaf nodes comprises:

iteratively grouping the points remaining after selecting the first subset into the further subsets based on coordinates in the MDS space of the remaining points.

54. (New) The machine-readable medium of claim 53, wherein the points are grouped using a median cut algorithm.

55. (New) The machine-readable medium of claim 53, wherein the coordinates of the remaining points are calculated using a single node update process.

56. (New) The machine-readable medium of claim 53, wherein creating a plurality of leaf nodes further comprises:

running MDS on the further subsets of points to define the local MDS spaces.

57. (New) The machine-readable medium of claim 49, wherein each node further comprises a map relating distances between pairs of points in the associated MDS space with the attribute proximities between the corresponding objects.

58. (New) The machine-readable medium of claim 49, wherein the leaf nodes further comprise coordinates for any overlapping portions of the associated local MDS spaces.

59. (New) The machine-readable medium of claim 49, wherein the method further comprises:

identifying a node for a new point corresponding to a new object based on attribute proximities between the new object and existing objects.

60. (New) The machine-readable medium of claim 59, wherein the method further comprises:

adding the new point into the subset associated with the identified node; and

redefining the local MDS space for the identified node.

61. (New) The machine-readable medium of claim 60, wherein adding the new point comprises:

calculating coordinates of the new point using a single node update process.

62. (New) The machine-readable medium of claim 60, wherein redefining the local MDS space comprises:

running MDS on the subset associated with the identified node.

63. (New) The machine-readable medium of claim 60, wherein the method further comprises:

recalculating the boundary information in the root node for the local MDS space for the identified node.

64. (New) The machine-readable medium of claim 60, wherein the method further comprises:

redefining the local MDS space for a traversed node, the traversed node located between the root node and the identified node; and

recalculating the boundary information in the root node for the local MDS space for the traversed node.

65. (New) The machine-readable medium of claim 60, wherein the method further comprises:

redefining the MDS space for the root node; and

recalculating the boundary information in the root node for the local MDS spaces.

66. (New) The machine-readable medium of claim 59, wherein the method further comprises:

determining points in the subset associated with the identified node that are within a pre-determined distance of the new point.

67. (New) The machine-readable medium of claim 66, wherein the method further comprises:

determining points in the subset associated with a traversed node that are within the pre-determined distance of the new point, the traversed node located between the root node and the identified node.

68. (New) A machine-readable medium having executable instructions to cause a processor to perform a method of querying a hierarchical data structure of root and leaf nodes representing an MDS (multidimensional scaling) space defined by a set of points that correspond to a set of objects, wherein distances between pairs of points in the

MDS space represent attribute proximities for the corresponding pairs of objects, the root node comprises coordinates in the MDS space for a first subset of the set of points and boundary information in the MDS space for local MDS spaces defined by further subsets of the set of points, and each leaf node comprises coordinates in a local MDS space for the points in one of the further subsets, the method comprising:

identifying a node for a new point corresponding to a new object based on attribute proximities between the new object and existing objects.

69. (New) The machine-readable medium of claim 68, wherein the method further comprises:

adding the new point into the subset associated with the identified node; and

redefining the local MDS space for the identified node.

70. (New) The machine-readable medium of claim 69, wherein adding the new point comprises:

calculating coordinates of the new point using a single node update process.

71. (New) The machine-readable medium of claim 69, wherein redefining the local MDS space comprises running MDS on the subset associated with the identified node.

72. (New) The machine-readable medium of claim 69, wherein the method further comprises:

recalculating the boundary information in the root node for the local MDS space for the identified node.

73. (New) The machine-readable medium of claim 69, wherein the method further comprises:

redefining the local MDS space for a traversed node, the traversed node located between the root node and the identified node; and

recalculating the boundary information in the root node for the local MDS space for the traversed node.

74. (New) The machine-readable medium of claim 69, wherein the method further comprises:

redefining the MDS space for the root node; and

recalculating the boundary information in the root node for the local MDS spaces.

75. (New) The machine-readable medium of claim 68, wherein the method further comprises:

determining points in the subset associated with the identified node that are within a pre-determined distance of the new point.

76. (New) The machine-readable medium of claim 75, wherein the method further comprises:

determining points in the subset associated with a traversed node that are within the pre-determined distance of the new point, the traversed node located between the root node and the identified node.

77. (New) A computer system comprising:

a processor coupled to a memory through a bus; and

a process executed from the memory by the processor to cause the processor to represent an MDS (multidimensional scaling) space as a hierarchical data structure by creating a root node and a plurality of leaf nodes, the root node comprising coordinates in the MDS space for a first subset of a set of points defining the MDS space and further comprising boundary information in the MDS space for local MDS spaces defined by further subsets of the set of points, and each leaf node comprising coordinates in a local MDS space for the points in one of the further subsets, wherein the set of points correspond to a set of objects, and distances between pairs of points in the MDS space represent attribute proximities for the corresponding pairs of objects.

78. (New) The system of claim 77, wherein the process further causes the processor to select the first subset of points based on the distances between pairs of points.

79. (New) The system of claim 78, wherein the largest distance between a pair of points is used as base criteria for selecting points for the first subset.

80. (New) The system of claim 77, wherein the process further causes the processor to run MDS on the first subset of points to define the MDS space to create the root node.

81. (New) The system of claim 77, wherein the process further causes the processor to iteratively group the points remaining after selecting the first subset into the further subsets based on coordinates in the MDS space of the remaining points to create the plurality of leaf nodes.

82. (New) The system of claim 81, wherein the points are grouped using a median cut algorithm.

83. (New) The system of claim 81, wherein the coordinates of the remaining points are calculated using a single node update process.

84. (New) The system of claim 81, wherein the process further causes the processor to run MDS on the further subsets of points to define the local MDS spaces to create a plurality of leaf nodes.

85. (New) The system of claim 77, wherein each node further comprises a map relating distances between pairs of points in the associated MDS space with the attribute proximities between the corresponding objects.

86. (New) The system of claim 77, wherein the leaf nodes further comprise coordinates for any overlapping portions of the associated local MDS spaces.

87. (New) The system of claim 77, wherein the process further causes the processor to identify a node for a new point corresponding to a new object based on attribute proximities between the new object and existing objects.

88. (New) The system of claim 87, wherein the process further causes the processor to add the new point into the subset associated with the identified node, and redefine the local MDS space for the identified node.

89. (New) The system of claim 88, wherein the process further causes the processor to calculate coordinates of the new point using a single node update process to add the new point.

90. (New) The system of claim 88, wherein the process further causes the processor to run MDS on the subset associated with the identified node to redefine the local MDS space.

91. (New) The system of claim 88, wherein the process further causes the processor to recalculate the boundary information in the root node for the local MDS space for the identified node.

92. (New) The system of claim 88, wherein the process further causes the processor to redefine the local MDS space for a traversed node, the traversed node located between the root node and the identified node, and recalculate the boundary information in the root node for the local MDS space for the traversed node.

93. (New) The system of claim 88, wherein the process further causes the processor to redefine the MDS space for the root node, and recalculate the boundary information in the root node for the local MDS spaces.

94. (New) The system of claim 87, wherein the process further causes the processor to

determine points in the subset associated with the identified node that are within a pre-determined distance of the new point.

95. (New) The system of claim 94, wherein the process further causes the processor to

determine points in the subset associated with a traversed node that are within the pre-determined distance of the new point, the traversed node located between the root node and the identified node.

96. (New) A system comprising:

a processor coupled to a memory through a bus;

a process executed from the memory by the processor to cause the processor to query a hierarchical data structure of root and leaf nodes representing an

MDS (multidimensional scaling) space by identifying a node for a new point corresponding to a new object based on attribute proximities between the new object and existing objects, wherein the MDS space is defined by a set of points that correspond to a set of objects, distances between pairs of points in the MDS space represent attribute proximities for the corresponding pairs of objects, the root node comprises coordinates in the MDS space for a first subset of the set of points and boundary information in the MDS space for local MDS spaces defined by further subsets of the set of points, and each leaf node comprises coordinates in a local MDS space for the points in one of the further subsets.

97. (New) The system of claim 96, wherein the process further causes the processor to add the new point into the subset associated with the identified node and redefine the local MDS space for the identified node.

98. (New) The system of claim 97, wherein the process further causes the processor to calculate coordinates of the new point using a single node update process to add the new point.

99. (New) The system of claim 97, wherein the process further causes the processor to run MDS on the subset associated with the identified node to redefine the local MDS space.

100. (New) The method of claim 97, wherein the process further causes the processor to recalculate the boundary information in the root node for the local MDS space for the identified node.

101. (New) The system of claim 97, wherein the process further causes the processor to

redefine the local MDS space for a traversed node, the traversed node located between the root node and the identified node, and recalculate the boundary information in the root node for the local MDS space for the traversed node.

102. (New) The system of claim 97, wherein the process further causes the processor to

redefine the MDS space for the root node, and recalculate the boundary information in the root node for the local MDS spaces.

103. (New) The system of claim 96, wherein the process further causes the processor to

determine points in the subset associated with the identified node that are within a pre-determined distance of the new point.

104. (New) The system of claim 103, wherein the process further causes the processor to

determine points in the subset associated with a traversed node that are within the pre-determined distance of the new point, the traversed node located between the root node and the identified node.

105. (New) An apparatus to represent an MDS (multidimensional scaling) space as a hierarchical data structure, the MDS space defined by a set of points that correspond to a set of objects, wherein distances between pairs of points in the MDS space represent attribute proximities for the corresponding pairs of objects, the apparatus comprising:

means for creating a root node comprising coordinates in the MDS space for a first subset of the set of points, the root node further comprising boundary information in the MDS space for local MDS spaces defined by further subsets of the set of points; and

means for creating a plurality of leaf nodes, each leaf node comprising coordinates in a local MDS space for the points in one of the further subsets.

106. (New) The apparatus of claim 105 further comprising:

means for selecting the first subset of points based on the distances between pairs of points.

107. (New) The apparatus of claim 106, wherein the largest distance between a pair of points is used as base criteria for selecting points for the first subset.

108. (New) The apparatus of claim 105, wherein the means for creating a root node comprises:

means for running MDS on the first subset of points to define the MDS space.

109. (New) The apparatus of claim 105, wherein the means for creating a plurality of leaf nodes comprises:

means for iteratively grouping the points remaining after selecting the first subset into the further subsets based on coordinates in the MDS space of the remaining points.

110. (New) The apparatus of claim 109, wherein the points are grouped using a median cut algorithm.

111. (New) The apparatus of claim 109, wherein the coordinates of the remaining points are calculated using a single node update process.

112. (New) The apparatus of claim 109, wherein the means for creating a plurality of leaf nodes further comprises:

means for running MDS on the further subsets of points to define the local MDS spaces.

113. (New) The apparatus of claim 105, wherein each node further comprises a map relating distances between pairs of points in the associated MDS space with the attribute proximities between the corresponding objects.

114. (New) The apparatus of claim 105, wherein the leaf nodes further comprise coordinates for any overlapping portions of the associated local MDS spaces.

115. (New) The apparatus of claim 105 further comprising:

means for identifying a node for a new point corresponding to a new object based on attribute proximities between the new object and existing objects.

116. (New) The apparatus of claim 115 further comprising:

means for adding the new point into the subset associated with the identified node; and

means for redefining the local MDS space for the identified node.

117. (New) The apparatus of claim 116, wherein the means for adding the new point comprises:

means for calculating coordinates of the new point using a single node update process.

118. (New) The apparatus of claim 116, wherein the means for redefining the local MDS space comprises:

means for running MDS on the subset associated with the identified node.

119. (New) The apparatus of claim 116 further comprising:

means for recalculating the boundary information in the root node for the local MDS space for the identified node.

120. (New) The apparatus of claim 116 further comprising:

means for redefining the local MDS space for a traversed node, the traversed node located between the root node and the identified node; and

means for recalculating the boundary information in the root node for the local MDS space for the traversed node.

121. (New) The apparatus of claim 116 further comprising:

means for redefining the MDS space for the root node; and

means for recalculating the boundary information in the root node for the local MDS spaces.

122. (New) The apparatus of claim 115 further comprising:

means for determining points in the subset associated with the identified node that are within a pre-determined distance of the new point.

123. (New) The apparatus of claim 122 further comprising:

means for determining points in the subset associated with a traversed node that are within the pre-determined distance of the new point, the traversed node located between the root node and the identified node.

124. (New) A apparatus to query a hierarchical data structure of root and leaf nodes representing an MDS (multidimensional scaling) space defined by a set of points that correspond to a set of objects, wherein distances between pairs of points in the MDS space represent attribute proximities for the corresponding pairs of objects, the root node comprises coordinates in the MDS space for a first subset of the set of points and boundary information in the MDS space for local MDS spaces defined by further subsets of the set of points, and each leaf node comprises coordinates in a local MDS space for the points in one of the further subsets, the apparatus comprising:

means for receiving a query; and

means for identifying a node for a new point corresponding to a new object based on attribute proximities between the new object and existing objects.

125. (New) The apparatus of claim 124 further comprising:

means for adding the new point into the subset associated with the identified node; and

means for redefining the local MDS space for the identified node.

126. (New) The apparatus of claim 125, wherein the means for adding the new point comprises:

means for calculating coordinates of the new point using a single node update process.

127. (New) The apparatus of claim 125, wherein the means for redefining the local MDS space comprises:

means for running MDS on the subset associated with the identified node.

128. (New) The apparatus of claim 125 further comprising:

means for recalculating the boundary information in the root node for the local MDS space for the identified node.

129. (New) The apparatus of claim 125 further comprising:

means for redefining the local MDS space for a traversed node, the traversed node located between the root node and the identified node; and

means for recalculating the boundary information in the root node for the local MDS space for the traversed node.

130. (New) The apparatus of claim 125 further comprising:

means for redefining the MDS space for the root node; and

means for recalculating the boundary information in the root node for the local MDS spaces.

131. (New) The apparatus of claim 124 further comprising:

means for determining points in the subset associated with the identified node that are within a pre-determined distance of the new point.

132. (New) The apparatus of claim 131 further comprising:

means for determining points in the subset associated with a traversed node that are within the pre-determined distance of the new point, the traversed node located between the root node and the identified node.